sweeping ephemerides for the whole year were published from Strassburg some time since, and will be found in the *Viertel-jahrsschrift der Astronomischen Gesellschaft*, Jahrgang 12. Those given above apply to greater distance from perihelion.

THE TRANSIT OF VENUS, 1882.—At the sitting of the Paris Academy of Sciences, on the 2nd inst., the Minister of Foreign Affairs transmitted a letter from the British Ambassador, on the part of his Government, desiring to be informed with which French authorities the Royal Society of London should communicate, with the view to an interchange of opinions relative to the observation of the approaching transit of Venus. The letter was referred to a commission already nominated.

COMET 1880, V. (PECHÜLE, DECEMBER 16).—This comet was followed by M. Bigourdan until March 31, efforts having been made at the Observatory of Paris to observe it as long as possible on account of the resemblance of the orbit to that of the great comet of 1807. M. Bigourdan's last elements gave the place with errors of only 2s.·0 in right ascension, and 20″ in declination: they will be found in *Comptes rendus*, vol. xcii. p. 172.

COMET 1881, *a* (SWIFT, MAY 1).—We have received from the Imperial Observatory of Strassburg the following observation of the new comet, made by Dr. Hartwig with the "orbit-sweeper":—

May 5, at 14h. 56m. 9s.·8 mean time at Strassburg.
Right Ascension 0h. 19m. 17s.·76; Declination +32° 19′ 32″·3.

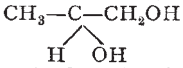
CHEMICAL NOTES

IN the *American Chemical Journal* Prof. Mallet describes a simple form of calorimeter whereby the specific heats of moderately small quantities of solids or liquids may be measured with a fair degree of accuracy. Mercury is employed, instead of water, as the material whose temperature is raised, and comparison is made, not of the total amounts of heat given out by different bodies on cooling, but of fractions of this heat rendered as nearly as possible equal.

IN *Compt. rend.* Berthelot gives several thermal measurements showing that in the substitution of halogens for hydrogen in hydrocarbons, the quantity of heat evolved varies according to the series and chemical function of the hydrocarbons employed, and is generally smaller the greater the number of halogen atoms substituted. The heat of formation of chloral alcoholate in various physical states is also considered by Berthelot: among other results it is shown that chloral hydrate is decomposed by an excess of absolute alcohol, but that the alcoholate is decomposed by much water; in the former of these actions there is exhibited the decomposition of a more volatile compound—chloral hydrate—and formation of a less volatile—chloral alcoholate; and at the same time the expulsion of a less volatile substance—water—by a more volatile—alcohol.

THE proto-salts of chromium (or chromous salts) are unstable and but little known: in *Compt. rend.* M. Moissau describes two salts belonging to this series, viz., chromous chloride, $CrCl_2$, and chromous sulphate, $CrSO_4 7H_2O$.

IN the *Berichte* of the German Chemical Society Herr C. Zimmermann states that potassium permanganate may be used for determining iron in presence of considerable quantities of hydrochloric acid, if a solution of manganous chloride, or preferably manganous sulphate, be added previous to titration.

ACCORDING to the hypothesis of Vant' Hoff, propyl glycol ought to be an optically active liquid, inasmuch as the molecule of this compound contains one *asymmetric* carbon atom, *i.e.* an atom directly united with four different radicles;—propyl glycol being formulated as  $CH_3—C(H)(OH)—CH_2OH$ Le Bel has recently shown (*Compt. rend.*) that if ordinary propyl glycol—from glyceric acid—be subjected to partial fermentation, the unfermented residue exhibits slight dextrorotatory powers. Le Bel thinks that ordinary propyl glycol contains both an optically active and an optically inactive modification, and that the latter being decomposed by the ferment, the presence of the former is rendered evident. From optically active propyl glycol Le Bel has prepared an active propylene oxide boiling at 35°, which he states is the most volatile optically active compound at present known.

A SERIES of optically active amylamines is described in *Compt. rend.* by M. Plimpton. These compounds are obtained from amyl bromide—from active amylic alcohol—by the action of alcoholic ammonia.

IN *Chem. Centralblatt* E. Ludwig describes experiments on the localisation of arsenic, absorbed as arsenious oxide, in the animal organism: contrary to the results of many former experimenters, Ludwig asserts that an accumulation of arsenic occurs in the liver: neither the bones nor the brain retain arsenic for any length of time. Arsenic was detected in the liver of a dog forty days after the last dose had been administered, but no trace could be found in the brain, bones, or muscles. Ludwig's results are generally confirmed by Johnson and Chittenden (*Amer. Chem. Journ.*).

MM. DES CLOIZEAUX AND DAMOUR describe (*Compt. rend.*) a new selenite of copper, to which they give the name *Chalcomenite*. The mineral occurs in the Argentine Republic, in small green clinorhombic crystals, associated with selenite of lead, and selenite of lead and copper.

M. SULLIOT proposes (*Compt. rend.*) to employ "chamber crystals" as a disinfectant. He places a solution of these crystals in sulphuric acid in the room or other place to be disinfected; the atmospheric moisture slowly decomposes the liquid with liberation of oxides of nitrogen, which destroy noxious organic matter present in the air.

MR. M. W. WILLIAMS describes, in *Chem. Soc. Journal*, a method for freeing water, to be analysed by the process of Frankland and Armstrong, from nitrates and ammonia. He digests the water with carefully-prepared "copper-zinc couple," whereby all nitrates are reduced to ammonia; he then distils off ammonia, evaporates to dryness, and proceeds in the usual manner. The use of sulphurous acid, which has always been much objected to, is thus obviated.

IN the same journal there is a suggestive paper by Prof. Hartley on the "Relation between the molecular structure of carbon compounds and their absorption-spectra." Evidence is accumulated in favour of the view that the selective absorption exhibited by "aromatic" compounds depends on the vibrations of the carbon atoms within the molecule, but that these atomic vibrations are dependent upon the nature of the molecular vibrations themselves, and are probably to be regarded as harmonics of these fundamental vibrations.

THE second and third parts of the *Gazetta Chimica Italiana* for the present year exhibit very unmistakably the activity of Italian chemists, chiefly in the domain of organic chemistry. Schiff continues his researches on Glucosides; the derivatives of thymol are studied by Paternò and Canzoneri; Macagno describes experiments on the spectroscopic detection of artificial colouring matters in wines. Koenig, Schiaparelli, Barbaglia, and other known chemists contribute papers.

GEOGRAPHICAL NOTES

MR. EDWARD WHYMPER on Monday last addressed a large meeting of the Geographical Society on some features in his recent journey among the Great Andes of the Equator. His paper was not, however, of so popular a nature as those which he read before the Alpine Club and the Society of Arts. The chief facts left on the minds of his very attentive audience may be briefly stated. Mr. Whymper found by careful experiments that aneroid barometers are not to be depended upon for the determination of heights, and that there is a remarkable difference in altitudes as fixed by the boiling point of water and the mercurial barometer. He asserted, as the result of his observations, that it is a mistake to suppose that there are two parallel chains in the Ecuadorian Andes, as usually shown on our maps. This is a point, however, on which more light is evidently required. Mr. Whymper's account of his ascent of the hitherto unknown peak called Sara-Urcu, was very interesting, and this achievement alone would stamp him a mountaineer of the highest skill and courage.

THE following award has just been made of the medals given annually by the Council of the Geographical Society for competition among a limited number of public schools:—Physical Geography (Mr. H. N. Moseley, F.R.S., examiner): Gold medal, E. G. Reid, Dulwich College; silver medal, Sydney Edkins, City of London School; Political Geography (Right Rev. Bishop Abraham, examiner): Gold medal, Theodore

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Brooks, London International College; silver medal, Chas. Th. Knaus, Dulwich College.

The *Willem Barents*, the little Polar ship which has already made three voyages to the Northern Polar Sea, has left Amsterdam for the fourth time. The crew consists of a lieutenant of the Royal Navy, H. van Broekhuyzen, as captain, two other officers, a physician, a zoologist, a photographer (the Englishman, Mr. Grant), and six sailors.

Doctors Arthur and Aurel Krause have left Bremen to spend some time in the neighbourhood of Behring Straits for the purpose of exploring and collecting, at the expense of the Bremen Geographical Society. They will visit the Chukchi peninsula, Behring Islands, and Alaska, where they will make zoological collections and carry on various scientific observations.

Mr. Henry Soltau and Mr. J. W. Stevenson, of the China Inland Mission, have successfully made the journey from Bhamo into China, reaching I-chan-fu, on the Yang-tsze-kiang, on March 14. This is the first time that it has been accomplished by Europeans, and the time occupied was about four months.

The first paper in the May number of *Petermann's Mittheilungen* is a study of the Padolian Dniester region by Ritter v. Habdank Dumkowski. This is followed by the continuation of Dr. Radde's account of his journey to Talysh, Aderbeijan and the Sawalan; M. Charnay's expedition to Central America from the *North American Review;* M. Potanin's researches in Western Mongolia in 1876-77, with a map; Recent Surveys in the Western United States, with a map; and the usual Monthly Notes. Among the latter is a long account of Dr. Lenz's journey to Timbuctoo, with a sketch-map.

We have received Nos. 1 and 3 of the *Bulletin* of the American Geographical Society, the two most important papers in which are on the recent investigations of the Gulf Stream, by the U.S. Coast Survey steamer *Blake*, by Commander J. R. Bartlett, and Changes in the Physical Geography of the Ancient Home of Man in Central and Western Asia, by the Rev. Owen Street.

Dr. Moffat, the venerable missionary and pioneer explorer in Africa, was entertained at a banquet in the Mansion House on Saturday.

The *Bulletin* of the Society of Commercial Geography of Bordeaux contains a brief statement of M. Paul Soleillet's views on the African question. After addressing the Society M. Soleillet proceeded to Paris, but he entertains hopes of being able to return to West Africa in November.

THE PRODUCTION OF SOUND BY RADIANT ENERGY[1]

In my Boston paper on the photophone (Nature, vol. xxii. p. 500) the discovery was announced that thin disks of very many different substances *emitted sounds* when exposed to the action of a rapidly-interrupted beam of sunlight. The great variety of material used in these experiments led me to believe that sonorousness under such circumstances would be found to be a general property of all matter.

At that time we had failed to obtain audible effects from masses of the various substances which became sonorous in the condition of thin diaphragms, but this failure was explained upon the supposition that the molecular disturbance produced by the light was chiefly a surface action, and that under the circumstances of the experiments the vibration had to be transmitted through the mass of the substance in order to affect the ear. It was therefore supposed that if we could lead to the ear air that was directly in contact with the illuminated surface, louder sounds might be obtained, and solid masses be found to be as sonorous as thin diaphragms. The first experiments made to verify this hypothesis pointed towards success. A beam of sunlight was focussed into one end of an open tube, the ear being placed at the other end. Upon interrupting the beam, a clear musical tone was heard, the pitch of which depended upon the frequency of the interruption of the light and the loudness upon the material composing the tube.

While in Paris a new form of the experiment occurred to my mind, which would not only enable us to investigate the sounds produced by masses, but would also permit us to test the more general proposition that sonorousness, under the influence of intermittent light, is a property common to all matter. The substance to be tested was to be placed in the interior of a transparent vessel made of some material which (like glass) is transparent to light but practically opaque to sound.

Under such circumstances the light could get in, but the sound produced by the vibration of the substance could not get out. The audible effects could be studied by placing the ear in communication with the interior of the vessel by means of a hearing tube.

Some preliminary experiments were made in Paris to test this idea, and the results were so promising that they were communicated to the French Academy on October 11, 1880, in a note read for me by Mr. Antoine Breguet.

I wrote to Mr. Tainter suggesting certain experiments, and upon my return to Washington in the early part of January, Mr. Tainter communicated to me the results of the experiments he had made in my laboratory during my absence in Europe. He had commenced by examining the sonorous properties of a vast number of substances inclosed in test-tubes in a simple empirical search for loud effects. He was thus led gradually to the discovery that cotton-wool, worsted, silk, and fibrous materials generally, produced much louder sounds than hard rigid bodies like crystals, or diaphragms such as we had hitherto used.

In order to study the effects under better circumstances he inclosed his materials in a conical cavity in a piece of brass closed by a flat plate of glass. A brass tube leading into the cavity served for connection with the hearing-tube. When this conical cavity was stuffed with worsted or other fibrous materials the sounds produced were much louder than when a test-tube was employed. Mr. Tainter next collected silks and worsteds of different colours, and speedily found that the darkest shades produced the best effects. Black worsted especially gave an extremely loud sound.

About a teaspoonful of lamp-black was placed in a test-tube and exposed to an intermittent beam of sun-light. The sound produced was much louder than any heard before. Upon smoking a piece of plate-glass, and holding it in the intermittent beam with the lamp-black surface towards the sun, the sound produced was loud enough to be heard, with attention, in any part of the room. With the lamp-black surface turned from the sun the sound was much feebler.

Upon smoking the interior of the conical cavity and then exposing it to the intermittent beam with the glass lid in position as shown, the effect was perfectly startling. The sound was so loud as to be actually painful to an ear placed closely against the end of the hearing-tube. The sounds, however, were sensibly louder when we placed some smoked wire gauze in the receiver.

When the beam was thrown into a resonator, the interior of which had been smoked over a lamp, most curious alternations of sound and silence were observed. The interrupting disk was set rotating at a high rate of speed, and was then allowed to come gradually to rest. An extremely feeble musical tone was at first heard, which gradually fell in pitch as the rate of interruption grew less. The loudness of the sound produced varied in the most interesting manner. Minor reinforcements were constantly occurring, which became more and more marked as the true pitch of the resonator was neared. When at last the frequency of interruption corresponded to the frequency of the fundamental of the resonator, the sound produced was so loud that it might have been heard by an audience of hundreds of people.

The extremely loud sounds produced from lamp-black have enabled us to demonstrate the feasibility of using this substance in an articulating photophone in place of the electrical receiver formerly employed. Words and sentences spoken into the transmitter in a low tone of voice were audibly reproduced by the lamp-black receiver at forty metres distance.

In regard to the sensitive materials that can be employed, our experiments indicate that in the case of solids the physical condition and the colour are two conditions that markedly influence the intensity of the sonorous effects. The loudest sounds are produced from substances in a loose, porous, spongy condition, and from those that have the darkest or most absorbent colours. The materials from which the best effects have been produced are cotton-wool, worsted, fibrous materials generally, cork, sponge, platinum and other metals in a spongy condition, and lamp-black.

The loud sounds produced from such substances may perhaps be explained in the following manner:--Let us consider, for

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[1] Abstract of a paper by Prof. Alexander Graham Bell, read before the National Academy of Arts and Sciences, April 21, 1881.

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